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EFFECT OF BORON AND MAGNESIUM ON THE GROWTH, YIELD AND SEED PROTEIN CONTENT OF MUNGBEAN

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ABSTRACT

An experiment was carried out to study the effect of boron and magnesium on the growth, yield and seed protein content of BARI mung 05 cv. The experiment was conducted with three levels of boron and four levels of magnesium. Result revealed that among the three boron levels B_5 treatment showed significantly superior effect on pods plant^{-1}, seeds pod^{-1}, 1000 grain weight, seed yield and protein content of seeds. Among the four levels of magnesium, Mg_5 treatment produced the highest yield, pods plant^{-1}, seeds pod^{-1}, and 1000-grain weight, yield and protein content of seeds. The interaction treatment $B_5 \times Mg_5$ performed the best result in terms of yield, yield attributing characters and protein content of seeds.

Key word: growth, yield, seed protein content and mungbean

INTRODUCTION

Mungbean (Vigna radiata L. Wilezek) is one of the most important pulse crops of Bangladesh. It ranks 5th both in acreage and production and 1st in market price among the pulses of Bangladesh. It serves as the main sources of protein for the poor people of Bangladesh. This also serves as the best source of protein for domestic animals. It can fix large amount of atmospheric nitrogen by symbiotic association with *Rhizobium* and help to maintain the fertility of soil.

In our country almost every farmer keeps a portion of his produce as seed, which did not receive due care at the time of its production. As a result the seeds are not quality ones.

Boron is essential for cell division in the process of nodule formation, which is a potential source of N. Its deficiency induces male sterility (Islam *et al.*, 1999).

Magnesium is another nutrient that increase nodulation, number of filled pods plant^{-1} and the pod yields. Seed quality of mungbean is affected by magnesium. Magnesium, like nitrogen is the component of chlorophyll and is essential for amino acids and fat synthesis. It also affects the viability of seeds. Keeping the above points in view, the present study was undertaken to study the effect of boron and magnesium on the yield and yield contributing characters of mungbean.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field of Hajee Mohammad Danesh Science and Technology University, Dinajpur during the period from March 2006 to April 2007. The soils belong to the Old Himalayan Piedmont Plain under the Agro-ecological Zone (AEZ–1). The land topography is medium high and soil texture sandy loam with P^H 5.1.

The trial consists of two factors viz. A) Boron i. No boron (B_0) ii. 5 kg ha^{-1} B (B_5) iii. 10 kg ha^{-1} B (B_{10}) and B) Magnesium i. No magnesium (Mg_0), ii. 5 kg ha^{-1} Mg (Mg_5), iii. 10 kg ha^{-1} Mg (Mg_{10}), iv. 15 kg ha^{-1} Mg (Mg_{15}).

The experiment was laid out in a Randomized Complete Block Design (RCBD) (factorial) with three replications.

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The unit plot size was $10m^2$ (2.5 m × 4 m). Seeds of BARI mung-5 were sown in the furrows on 7 March, 2006 and the furrows were covered with soils soon after seeding. The line to line (furrow to furrow) distance was maintained at 30 cm with continuous sowing of seeds in the line. After 15 DAS thinning was done to maintain plant to plant distance at 10 cm.

The plants were selected randomly from each plot at harvest to record the crop characters. The mature pod was collected from a demarcating area ($1\ m^2$) of each plot. The seeds were separated from the pods and recorded the weight and converted the seed yield as ton ha^{-1}.

Protein content in mungbean seed was estimated at the quality control laboratory of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensing by Kjeldahl method. The crude protein content of the seed was obtained by multiplying %N with 6.25 (a factor).

The collected data were analyzed statistically with the help of a computer program MSTAT-C and the mean differences were adjudged by the Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The crop characters, yield attributes, yield and seed protein content are presented in Table-1. Plant height was significantly influenced by boron fertilizer. Plant fertilized with 5 kg boron ha^{-1}(B_5) gave the tallest plant and the shortest was obtained from (B_{10}). This might be due to the toxic effect of B which is in close conformity with the findings of Nable *et al.* (1997). Magnesium had no significant effect on plant height. Interaction effect of boron and magnesium was not significant in respect of plant height.

The number of branches $plant^{-1}$ varied significantly due to the application of different levels of boron. The highest number of branches $plant^{-1}$ was counted from the treatment 5 kg B ha^{-1} and the lowest number of branches $plant^{-1}$ from the control plot, which was statistically identical with 10 kg B ha^{-1}. Branch $plant^{-1}$ was not significantly affected by magnesium level. Interaction of boron and magnesium was significantly influenced in respect of number of branches $plant^{-1}$. The maximum number of branches $plant^{-1}$ was counted when 5 kg B ha^{-1} along with 5 kg Mg ha^{-1} were applied.

Different boron levels significantly affected the number of pods $plant^{-1}$. The highest number of pods $plant^{-1}$ was produced from 5 kg B ha^{-1}. The lowest number of pods $plant^{-1}$ was obtained from the control treatment. It was noticed that number of pods $plant^{-1}$ increased with the increased application of boron up to 5 kg ha^{-1}, after that it was declined. These findings are in close conformity with the findings of Noor *et al.* (1997).

Number of pods $plant^{-1}$ was significantly influenced by different magnesium levels. It was observed that maximum number of pods $plant^{-1}$was obtained from the treatment of 5 kg ha^{-1} which was statistically identical to the treatment 10 kg ha^{-1} and 15 kg ha^{-1} but was higher than the control (0 kg ha^{-1}).The interaction of boron and magnesium had also significant influence on the number of pods $plant^{-1}$. The highest number of pods $plant^{-1}$ which was obtained from the treatment combination of $B_5 \times Mg_5$ was significantly superior to all other values of pods $plant^{-1}$ obtained from the rest treatment combinations. The second highest value of pods $plant^{-1}$ was obtained from the treatment combination of $B_0\ Mg_5$ while the lowest value of pods $plant^{-1}$ was obtained from the control (B_0Mg_0).

There was no significant effect of boron and Mg either alone or appliedin combination on pod length. The highest number of seeds pod^{-1} was found from the treatment of 5 kg B ha^{-1}, while the lowest from the treatment of 10 kg B ha^{-1}, which was statistically identical with control. The result might be due to optimum boron reduced pollen sterility and this increased the number of seeds pod^{-1}. This finding is similar with the findings of Rerkasem *et al.* (1987) with green gram.

Application of Mg showed significant variation on the seed pod^{-1} of mungbean. The highest number of seeds pod^{-1} was obtained with 5 kg Mg ha^{-1}. The higher doses of MG (10 and 15 kg Mg ha^{-1}) showed a decline in the number of seeds pod^{-1}

Table 1. Crop characters yield; yield attributes and seed quality of mungbean as affected by boron, magnesium and their combined effect

Treatment/ Interaction	Plant height (cm)	Branches plant^{-1} (no)	Pods plant^{-1} (no)	Pod length (cm)	Seed pod^{-1} (no)	1000 seed wt (g)	Seed yield (kg ha^{-1})	Protein content (%)
Boron level (kg ha^{-1})								
B_0	58.55 b	1.81 b	16.18c	6.73	8.17 b	30.89b	979.50 b	20.17b
B_5	60.89 a	2.14 a	18.13a	6.75	9.13 a	31.98a	1103.00 a	21.56a
B_{10}	56.22 c	1.97 b	16.68b	6.71	7.75 b	31.12b	931.75 b	19.85b
Level of significance	**	**	*	NS	**	**	**	**
CV (%)	9.66	10.17	9.95	6.76	8.47	3.58	8.04	2.89
Magnesium level (kg ha^{-1})								
Mg_0	57.78	1.94	15.24b	6.54	7.86 c	30.82b	937.33 c	19.65c
Mg_5	59.04	1.98	18.01a	6.73	9.76 a	31.99a	1111.00 a	21.08a
Mg_{10}	58.65	1.96	17.81a	6.95	8.44 b	31.5ab	1010.00 b	20.74ab
Mg_{15}	58.73	1.88	16.92a	6.71	8.13 b c	30.79b	960.33 bc	20.64b
Level of significance	NS	NS	**	NS	**	**	**	**
CV (%)	9.66	10.17	1.294	6.76	8.47	3.58	8.04	2.89
Interaction								
$B_0 \times Mg_0$	60.27	1.93 cde	11.33f	6.26	11.33 f	31.56 bc	820.00e	19.17ef
$B_0 \times Mg_5$	57.20	2.03 bc	19.13b	7.08	19.13 b	31.18 bcd	962.33d	20.37d
$B_0 \times Mg_{10}$	59.33	1.47 g	17.63cd	7.08	17.63 cd	31.09 bcd	1039.67c	19.57e
$B_0 \times Mg_{15}$	57.40	1.80 ef	17.57cd	6.59	17.57 cd	30.64 de	1096.00b	21.57b
$B_5 \times Mg_0$	60.33	2.23 cde	16.87d	6.70	16.87 d	31.88 b	1007.33cd	21.15c
$B_5 \times Mg_5$	62.00	2.77 a	20.33a	6.52	20.33 a	33.81 a	1415.33a	23.85a
$B_5 \times Mg_{10}$	60.57	1.66 f	18.20bc	6.86	18.20 bc	31.15 bcd	994.33cd	20.29d
$B_5 \times Mg_{15}$	60.67	1.86 de	18.17bc	6.76	18.17 bc	31.09 bcd	995.00cd	20.95c
$B_{10} \times Mg_0$	52.73	2.00 bcd	18.40bc	6.66	18.40 bc	31.21 bcd	984.66cd	21.19b
$B_{10} \times Mg_5$	57.93	1.80 ef	14.57e	6.58	14.57 e	30.97 cde	956.67d	19.03f
$B_{10} \times Mg_{10}$	56.06	2.13 b	19.93e	6.92	14.93 e	30.21 e	995.67cd	19.09f
$B_{10} \times Mg_{15}$	58.13	2.00 bcd	16.83d	6.77	16.83 d	31.18 bcd	790.00e	19.39ef
Level of significance	NS	**	**	NS	**	**	*	**
CV (%)	9.66	10.17	9.95	6.76	9.95	3.58	8.04	2.89

In a column, the treatment means having similar letter(s) do not differ significantly

*=Significant at 5% level of probability

**= Significant at 1% level of probability

The interaction effects between boron and magnesium on seeds pod^{-1} was significant. The highest number of seeds pod^{-1} was found with 5 kg B ha^{-1} × 5 kg Mg ha^{-1}

The highest 1000 seed weight was obtained with 5 kg B ha^{-1} and the lowest with control which was statistically identical to that of 10 kg B ha^{-1}.The result might be due to the impact of boron on cell development, sugar and starch formation and translocation and synthesis of protein .

The highest 1000 seed weight was recorded from the crop fertilized with 5 kg Mg ha^{-1} which was followed by 10 kg Mg ha^{-1}. The maximum 1000 seed weight was obtained with 5 kg B ha^{-1} × 5 kg Mg ha^{-1}. The lowest1000 seed weight obtained from the treatment combination of10 kg B ha^{-1} ×10 kg Mg ha^{-1}.

Seed yield differed significantly due to different boron levels. The highest yield was obtained with 5 kg B ha^{-1} (1103.00 Kg ha^{-1}) and the lowest (931.75 kg ha^{-1}) from 10 kg B ha^{-1} which was at par with B_0. Same results were obtained by Verma and Mishra (1999) while they worked with mungbean. The highest seed yield (1111.00 Kg ha^{-1}) was obtained with 5 kg Mg ha^{-1} and the lowest (937.33 kg ha^{-1}) from control. Similar results were found by Reinbott and Blevins (1995) while working with mungbean. The highest yield was obtained from 5 kg B × 5 kg Mg ha^{-1} .and the lowest from control. The second highest yield ha^{-1} obtained from the treatment combination 0 kg B × 15 kg Mg ha^{-1} was superior to the yield values obtained from the rest treatment combinations. The 3rd highest yield ha^{-1} obtained from the combination of 0 kg B and 10 kg Mg ha^{-1} was identical with those obtained respectively from the treatment combination of B_5 Mg_0, B_5Mg_{10}, B_5 Mg_{15}, B_{10} Mg_0 and B_{10} Mg_{10}. It reveals from the table that the interaction effect of boron and magnesium with increased rate had a negative influence on the yield of mungbean, which resulted in the declination of its yield less than that obtained under control treatment combination.

Boron had significant effects on the protein content of mungbean seeds. The highest protein content was found with 5 kg B ha^{-1} while the other two treatments produced identical results. This might be due to the fact that boron affects carbohydrate metabolism and plays an important role in amino acid formation. It was observed that the highest protein content of mungbean seed was obtained with 5 kg Mg ha^{-1}.This might be due to effect of magnesium as it is a constituent of chlorophyll and important cofactor of electron transport system which increases the synthesis of protein and finally increased the protein content of seed. These findings are in close conformity with the findings of Wu Ying (1998), where he found that magnesium increases seed protein in soybean by 8.8%.

The interaction effects between boron and magnesium levels had a significant effect on protein content of mungbean seeds. The highest protein content of mungbean seeds (23.85 %) was found with 5 kg B ha^{-1}× 5 kg Mg ha^{-1} and the lowest (19.17%) was with control.

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